

The transistor of FIG. 5 can be operated to provide substantially the same action as a vacuum tube. In such case, the emitter 42 is biased negative with respect to the base electrode 41, and the input signal is applied to the terminal 45 so that the embedded layer 43 acts as a grid. The terminal 45 presents a high impedance in the same manner as the grid of a tube. The load is again connected to the collector region.

When layer 45 is used as a "grid," this transistor is very analogous to a vacuum tube triode. Reverse biasing this "grid" with respect to its surroundings introduces a potential hill in the voltage profile, as is shown in FIG. 6. Electrons in transit to the collector region, which is analogous to the vacuum tube plate, must surmount this hill. (Electrons move up on this diagram.) Thus the base and emitter regions combined are analogous to the vacuum tube cathode which supplies electrons for controlled transfer to the collector or plate.

Transistors constructed in accordance with the invention are highly desirable in applications where high power, high frequency operation is required. One such application is a radio frequency amplifier stage where large voltage swings at high frequency are encountered. Another application is in a line distribution amplifier which applies video signals to a coaxial line. The transistor of the invention provides improved performance because the gain remains constant over a large range of applied voltages. However, by applying a bias potential to the lock layer, a controlled variation in gain can be provided and this can be utilized as in an automatic gain control amplifier. As has been fully set forth, the transistor may also be used as an analog transistor by applying the input voltage to the embedded layer.

I claim:

1. A semiconductor device including a body of semiconductor material having a base region of one conductivity type, and emitter and collector regions of a conductivity type opposite to said one conductivity type, said emitter and collector regions each forming a junction with said base region, said emitter region having a transverse extent less than that of said base and collector regions, a lock region of said one conductivity type at least partially embedded in said collector region and spaced from the junction between said collector and base regions, said lock region having a greater transverse extent than said emitter region and being completely coextensive with said emitter region but of less transverse extent than said collector region, and circuit means electrically connected to said base and collector regions and providing a direct current bias potential therebetween, so that a depletion layer forms at the junction between said collector and base regions and extends therefrom into both said regions, said lock region being positioned to be engaged by said depletion layer before said layer reaches said emitter region, so that said depletion layer punches through at said lock region and is prevented from extending further toward said emitter region, said circuit means including portions connected to said emitter and lock regions for applying first and second control signals respectively thereto, for controlling the conduction between said base and collector regions.

2. A semiconductor device including a body of semiconductor material having an intermediate region of first conductivity type material with first and second regions of opposite conductivity type and forming respectively first and second rectifying junctions with the intermediate region, the second junction having a smaller lateral extent than the first junction, the improvement including in combination,

a depletion-layer shaping-and-locking region having the first conductivity type material and at least partially embedded in said first region extending in spaced parallel relation to said junction forming a first portion in said first region and of lateral extent at least as great as lateral extent of the second junction

tion for limiting penetration of any depletion layer about said first junction toward said second junction by being spaced from said first junction such that the depletion region thereof reaches said locking region before reaching the second junction and said first region including a second portion outside the lateral extent of said locking region wherein depletion is not limited in penetration by said locking region into the first and second regions.

3. A semiconductor device with a semiconductor body having major surfaces with edges forming its periphery having first, second and third regions with first and second junctions therebetween with the second junction being of lesser lateral extent than the first junction and the second region being subject to punch-through and consisting of conductivity type material opposite to the type material in the first and third regions, the improvement including in combination,

a lock region of the second region conductivity type material at least partially embedded in said first region having a section extending in spaced parallel relation to the first junction forming a first portion between the first junction and the lock region laterally coextensive with the second junction such that the penetration of a depletion layer about the first junction reaches said lock region before reaching said second junction and is thereby limited in penetration by said lock region, and

a second portion in said first region adjacent said lock region laterally outside said first portion wherein penetration of such first junction depletion layer is not limited by said lock region.

4. The improvement in a semiconductor device as set forth in claim 3 wherein said lock region extends to a surface for accommodating an external electrical connection.

5. The improvement in a semiconductor device as set forth in claim 4 wherein said first and second junctions intersect the same surface of the semiconductor body and said lock region has a section extending to said same surface.

6. The improvement in a semiconductor device as set forth in claim 5 wherein said lock region surface extending sections form a portion of one edge of said body adjacent said same surface.

7. The improvement in a semiconductor device as set forth in claim 5 wherein said surface extending section forms an L-shaped region with said spaced section extending along said first junction with the juncture of the two mentioned lock region sections forming an acute angle opening toward said first junction.

8. A semiconductor device including a body of semiconductor material having a base region of one conductivity type, and emitter and collector regions of a conductivity type opposite to said one conductivity type, said emitter and collector regions each forming a junction with said base region, a lock region of said one conductivity type at least partially embedded in said collector region and spaced from the junction between said collector and base regions and being of greater lateral extent than and disposed opposite and in parallel relation to said emitter region and being of lesser lateral extent than said collector region, so that any depletion layer forming at the junction between said collector and base regions and extending therefrom into both such regions reaches said lock region before said emitter region and is limited in depth of penetration into said base and collector regions inhibiting said layer from reaching said emitter region and an electrical connection to said collector region spaced from said lock region opposite said junctions, so that said depletion layer punches through at said lock region and is prevented from extending further toward said emitter region.

9. A semiconductor device having a body of semiconductor material with a base region of one conductivity type material and emitter and collector regions of ma-